

1 BACKGROUND OF THE INVENTION

The present invention relates to an image display apparatus including an input unit such as a keyboard, a computer body and a display unit, and more particularly to an image display apparatus in which a display size, a display position and brightness of a picture in the display unit can be adjusted by the input unit such as the keyboard through the computer body to improve the handling capability. The image display apparatus of the present invention can be used in a work station and an advanced personal computer using a display unit.

At present, in the display units for a computer terminal, the display position and size of the picture and a deflection frequency of a video signal to be displayed are variously different. Accordingly, one display unit for the computer terminal is designed to be able to treat various video signals.

The display unit of this type employs a microcomputer and an LSI memory to provide an optimum picture display for each kind of video signals. Such a display unit in a prior art is disclosed in Japanese Patent Unexamined Publication No. 1-321475, for example.

This conventional display unit is directed to a multi-scan type CRT display unit, which includes a

1 memory in which information relative to display
positions and sizes of the picture is stored for each
kind of video signals and which is controlled by a
microcomputer in that display unit. The information
5 relative to the optimum display position and size of the
picture in accordance with an input video signal is read
out from the memory and a deflection circuit of the
display unit is controlled by the read-out information.
Further, when a video signal inputted in the display
10 unit is not known, the memory stores no information
relative to the inputted video signal and accordingly
adjustment switches disposed on a front panel of the
display unit are operated without the intervention of
the computer so that information for adjusting the
15 display position and the display size of the picture is
inputted. A control circuit such as the microcomputer
prepares information for control including deflection
and makes adjustment.

In the prior art described above, the display
20 unit is designed to obtain the optimum picture display
in accordance with the input video signal, while, in
another prior art, a display state is controlled to be
switched from the computer body in accordance with the
variety of the multi-media. Such a display unit in the
25 prior art is disclosed in Japanese Patent Unexamined
Publication No. 2-60193.

This conventional display unit is directed to
a CRT display apparatus used in display of an electronic

1 apparatus such as a personal computer and which can
switch the number of scanning lines between 200 lines
and 400 lines freely and be shared by a television
receiver.

5 More particularly, in the above prior art, the
computer body produces a discrimination signal super-
posed on an video signal during a blanking period and
the display unit switches the deflection frequency on
the basis of the discrimination signal.

10 In the former prior art (Publication No. 1-
321475) of the above two prior arts, since the display
position and size of the picture are all controlled by
the display unit, it is necessary for the operator to
separate his fingers from the input unit such as the
15 keyboard connected to the computer body and extend his
hands to the adjustment switches of the display unit
disposed at a separate location to operate the switches
when the adjustment of the display position and size of
the picture are required. Accordingly, it is trouble-
20 some in the handling capability.

Further, in the latter prior art (Publication
No. 2-60193), the display state is controlled by the
input unit such as the keyboard connected to the
computer body, while since only the deflection frequency
25 can be switched only by a binary value, there is a
problem that only two specific signals can be treated
and a sufficient display state required by the user of
the computer can not be obtained.

1 SUMMARY OF THE INVENTION

It is a primary object of the present invention to solve the problems in the prior arts by providing an image display apparatus capable of adjusting a display picture by an input unit such as a keyboard near at hand through a computer body without extending the hands to adjustment switches of a display unit and obtaining a display state required by the user exactly.

10 It is another object of the present invention to improve the operability in a computer system and the handling capability of the image display apparatus.

15 It is still another object of the present invention to provide an image display apparatus capable of adjusting a display picture from a computer body by using a conventional circuit without the provision of a new circuit.

20 In order to solve the above problems, according to the present invention, in a general computer system, a computer body comprises addition means for adding a control signal for a display picture to a video signal or a synchronizing signal and a display unit comprises separation means for separating the added control signal and control means for adjusting the display state 25 on the basis of the separated control signal.

Alternatively, the computer body comprises preparation means for preparing the control signal to produce it with a predetermined system and the display

1 unit comprises control means for receiving the control
signal to adjust the display state on the basis of the
control signal.

Alternatively, the computer body comprises
5 display processing means for producing the prepared
image data and the control signal for the display
picture in the form of a digital signal to the display
unit and the display unit comprises control means for
preparing an analog video signal and synchronizing
10 signal from the image data and producing an adjustment
signal for adjusting a predetermined location of the
display unit on the basis of the control signal.

Alternatively, the computer body comprises
modulation means for adding the control signal for the
15 display picture to an AC power supply for operating the
computer body and the display unit comprises demodu-
lation means for separating the modulated control signal
and control means for adjusting an internal circuit of
the display unit by the control signal from the demodu-
20 lation means to obtain a predetermined display picture.

Further alternatively, the control signal from
the input unit such as the keyboard is received by the
display unit as it is and the display unit comprises
instruction identification means for identifying the
25 control signal relative to the adjustment of the display
picture and control means for adjusting the display
picture on the basis of a signal from the instruction
identification means.

1 The addition means of the computer body adds
the control signal for the display unit to the video
signal or the synchronizing signal produced by the
computer body when the instruction inputted by the input
5 unit such as the keyboard relates to the adjustment of
the display picture of the display unit. In the display
unit, the separation means takes out the added control
signal and the control means adjusts the internal cir-
cuit of the display unit in accordance with the control
10 signal to thereby display a predetermined picture.

15 Alternatively, the preparation means prepares
a control signal in accordance with the control signal
for the display picture from the input unit such as the
keyboard and produces it through an exclusive connection
line, and when the control means of the display unit
receives the control signal, the control means adjusts a
predetermined portion of the internal circuit of the
display unit in accordance with the control signal and
adjusts the display picture.

20 Alternatively, the display processing means
processes a drawing instruction prepared by a CPU in the
computer body to prepare image data for displaying a
video signal and prepare a control signal for the
display picture, so that the image data and the control
25 signal are produced to the display unit with a predeter-
mined system for transmission and reception of a digital
signal. Further, the control means receives the image
data and the control signal from the display processing

1 means and prepares the video signal, the synchronizing
signal and the adjustment signal for the internal
circuit of the display unit.

Alternatively, the modulation means prepares
5 the control signal for the display picture from the
information or instruction relative to the adjustment of
the display picture and adds the control signal to the
AC power supply for the computer body to transmit the
control signal. The demodulation means extracts the
10 control signal added by the modulation means. The
control means adjusts a predetermined portion of the
internal circuit of the display unit on the basis of the
control signal from the demodulation means to adjust the
display picture.

15 Further alternatively, the instruction
identification means identifies a signal relative to the
adjustment of the display picture from signals directly
inputted by the input unit such as the keyboard to
prepares the control signal for adjustment. The control
20 means adjusts the predetermined portion of the internal
circuit of the display unit in accordance with the con-
trol signal from the instruction identification means to
adjust the display picture.

BRIEF DESCRIPTION OF THE DRAWINGS

25 Preferred embodiments of the present invention
will now be described in conjunction with the accompany-
ing drawings, in which:

1 Fig. 1 is a block diagram schematically illustrating a first embodiment of an image display apparatus according to the present invention;

5 Fig. 2 is a block diagram schematically illustrating an actual example of a control signal addition circuit and a display control circuit shown in Fig. 1;

Fig. 3 is a waveform diagram of signals of
Fig. 2;

10 Fig. 4 is a block diagram schematically illustrating an actual example of a control signal separation circuit and the display control circuit shown in Fig. 1;

Fig. 5 is a waveform diagram of signals of
Fig. 4;

15 Fig. 6 is a block diagram schematically illustrating another actual example of the control signal addition circuit and the display control circuit shown in Fig. 1;

20 Fig. 7 is a block diagram schematically illustrating a second embodiment of an image display apparatus according to the present invention;

Fig. 8 is a block diagram schematically illustrating a third embodiment of an image display apparatus according to the present invention;

25 Fig. 9 is a block diagram schematically illustrating a fourth embodiment of an image display apparatus according to the present invention; and

Fig. 10 is a block diagram schematically illustrating a fifth embodiment of an image display

1 apparatus according to the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Fig. 1 is a block diagram schematically illustrating a first embodiment of an image display apparatus according to the present invention. In Fig. 1, numeral 1a denotes a computer body, in which numeral 11 a CPU, 12 an input unit interface connected to the computer body 1a for processing various instruction signals inputted from a first input unit 10 (which transmits a user's intention to the computer) such as a keyboard, a mouse, a pen for input, 13 a memory circuit constituting a main memory, 14 an input/output port for connection with a peripheral device not shown, 15 a display control circuit for producing a video signal and a synchronizing signal for driving a display unit, 16 a control signal addition circuit for superposing or adding a control signal to the video signal or the synchronizing signal produced by the display control circuit 15, and 17 an external memory constituted by a floppy disk, a hard disk or a memory card which is disposed separately from the memory circuit 13. Further, numeral 1b denotes a display unit, in which numeral 18 denotes a control signal separation circuit for extracting the control signal from the video signal or the synchronizing signal on which the control signal produced by the control signal addition circuit 16 is superposed, 19 a first display control circuit for producing an adjustment

1 signal for a predetermined circuit on the basis of the
control signal extracted by the control signal separa-
tion circuit 18, 20 a video circuit, 21 a deflection
circuit constituting display drive means, and 22 a
5 cathode ray tube for displaying a video signal.

Operation of Fig. 1 is now described. In the
computer body 1a, other portions except the control
signal addition circuit 16 are the same as the general
configuration of a conventional personal computer or
10 work station.

When the user of the computer inputs a control
instruction for adjustment of the display picture in the
display unit 1b by means of a first input unit 10 such
as a keyboard, a mouse, a pen for input connected to the
15 computer body 1a, the input unit interface 12 converts
the control instruction into a digital signal, which is
recognized by the CPU 11 which controls the control
signal addition circuit 16.

The control signal addition circuit 16 pre-
20 pares a control signal S_c in accordance with the control
instruction. The control signal S_c for the display unit
1b is superposed during the vertical retrace period on
the video signal R, G or B or the synchronizing signal
for display produced by the display control circuit 15.
25 The signal on which the control signal S_c is superposed
is represented with the prime (''). The control signal
 S_c is prepared in accordance with the control instruc-
tion inputted in the input unit 10.

1 The control signal separation circuit 18 of
the display unit 1b separates the added control signal
Sc from the video signal R, G or B or the synchronizing
signal Hs or Vs produced by the control signal addition
5 circuit 16 to supply it the first display control
circuit 19 and supplies the video signals R, G and B to
the video circuit 20 and the synchronizing signals Hs
and Vs to the deflection circuit 21, respectively.

10 The first display control circuit 19 produces
adjustment signals Sa and Sb for the video circuit 20
and the deflection circuit 21 on the basis of the
inputted control signal Sc, respectively, and supplies
the signals Sa and Sb to the video circuit 20 and the
deflection circuit 21, respectively, to adjust them.

15 In this way, the display picture is adjusted,
so that the user's desired picture is displayed in the
cathode ray tube 22.

20 Fig. 2 is a block diagram schematically illus-
trating an actual example of the control signal addition
circuit 16 of Fig. 1 and Fig. 3 is a waveform diagram
illustrating waveforms of signals in Fig. 2.

25 In Fig. 2, numeral 161 denotes an address
decoder, 162 a data latch circuit, 163 an edge detection
circuit for detecting an edge of a pulse, 164 a shift
register circuit, 165 and 170 AND circuits, 166 a level
conversion circuit for converting a level of a signal,
167 an analog switch, 168 a counter circuit for counting
17 clock pulses, and 169 a set and reset type flip-flop

1 circuit (hereinafter, referred to as an RSFF circuit).

Operation of Fig. 2 is now described.

As described above, when the user of the computer inputs the control instruction for adjustment
5 of the display picture of the display unit 1b by means of the input unit 10 connected to the computer 1a, the input unit interface 12 supplies the control instruction to the CPU 11 through a computer bus BUS. Then, the CPU 11 recognizes the control instruction and supplies a
10 control data C_D to the control signal addition circuit 16 through the computer bus BUS.

The address decoder 161 supplies the control data C_D to the data latch circuit 162 when the control data supplied to the decoder is a control data for
15 adjusting the display picture of the display unit 1b. Then, the edge detection circuit 163 detects a leading edge of the vertical synchronizing signal Vs by means of the horizontal synchronizing signal Hs and supplies the edge detection pulse Pe to the shift register circuit
20 164, the counter circuit 168 and the RSFF circuit 169.

The counter circuit 168 is supplied with the edge detection pulse Pe as a reset signal and with the horizontal synchronizing signal Hs as a clock signal and starts its counting operation in response to the rising
25 edge of the clock signal. When the counter circuit 168 counts 17 clocks after input of the reset signal, the counter circuit produces a carry output signal Sca which is supplied to a reset input terminal of the RSFF

1 circuit 169. Thus, the RSFF circuit 169 produces a V
gate pulse Pv as shown in Fig. 3. The control signal Sc
for the display unit 1b is superposed during a high
level period T_H of the V gate pulse Pv.

5 On the other hand, the shift register circuit
164 reads the control data C_D held in the data latch
circuit 162 in response to the edge detection pulse Pe
supplied from the edge detection circuit 163. The shift
register circuit 164 performs the shift operation in
10 response to the clock signal constituted by the hori-
zontal synchronizing signal Hs produced from the AND
circuit 170 during the high level period T_H of the V
gate pulse to produce the control data C_D' shown in Fig.
3.

15 Further, the control data C_D' is supplied to
the AND circuit 165 which produces a logical product of
the control data C_D' and the horizontal synchronizing
signal Hs. The output signal of the AND circuit is
converted into a video signal level by the level
20 conversion circuit 166 to be supplied to the switch
circuit 167. Other input of the switch circuit 167 is
supplied with a B (blue) video signal directly without
being processed, and the switch circuit 167 selects the
output of the level conversion circuit 166 during the
25 high level period T_H and the B video signal during other
low level period T_L by using the V gate pulse Pv as a
change-over control signal for the switch to be able to
obtain a B' video signal on which the control signal is

1 added as shown in Fig. 3. In the embodiment, the
control signal Sc is added to the B video signal having
a low visual sensitivity of color, while the control
signal may be added to other R (red) or G (green) visual
5 signal or the synchronizing signal Hs or Vs.

Fig. 4 is a block diagram schematically illustrating a first embodiment of the control signal separation circuit 18 and the first display control circuit 19 of Fig. 1 and Fig. 5 is a waveform diagram showing
10 waveforms of signals in Fig. 4.

In Fig. 4, numeral 401 denotes a distributor,
402 a low pass filter (hereinafter referred to as an
LPPF), 403 a level conversion circuit, 404 and 405
buffers, 406 a divide-by-17 counter or 17-step counter,
15 407 an RSFF circuit, 408 and 409 AND circuits, 410 an
inverter, 411 a 16-stage shift register, 412 a decoder
circuit, 413 a D/A conversion circuit (hereinafter
referred to as a D/AC), and 414 an edge detection
circuit.

20 Operation of Fig. 4 is now described with
reference to Fig. 5.

The B' video signal from the control signal
addition circuit 16 is supplied to the distributor 401
which divides the video signal into two signals, one of
25 which is supplied to the video circuit 20 shown in Fig.
1 together with other video signals R and G and the
other of which is supplied to the LPF 402. With the B'
video signal supplied to the LPF 402, an unnecessary

1 frequency component such as noise contained in the B' video signal is removed in the LPF 402 and the B' video signal is then converted into a digital signal level in the level conversion circuit 403.

5 Further, the vertical synchronizing signal Vs is supplied through the buffer 404 to the edge detection circuit 414, in which the leading edge thereof is detected and is supplied to the 17-step counter 406, the RSFF circuit 407 and the 16-stage shift register 411 as
10 an edge detection pulse 418 shown in Fig. 5.

When the 17-step counter circuit 406 is reset by the edge detection pulse 418, the 17-step counter circuit 406 starts its counting operation for the horizontal synchronizing signal Hs supplied through the buffer 405 as a clock signal. Thus, when rising edges of 17 clocks are counted, the counter circuit produces a 17-clock detection pulse. The RSFF circuit 407 is set by the edge detection pulse 418 and reset by the 17-clock detection pulse to produce the V gate pulse 419
15 shown in Fig. 5.

20 The AND circuit 408 takes a logical product of an output signal of the level conversion circuit 403 and the V gate pulse of the RSFF circuit 407 to extract the control signal 420 added to the B' video signal.

25 Further, the other AND circuit 409 takes a logical product of the V gate pulse and the horizontal synchronizing signal Hs produced by the buffer 405 and inverted by the inverter 410 to produce a clock signal for the

1 16-stage shift register 411 and the D/AC (D/A Converter)
413.

The 16-stage shift register 411 is reset by
the edge detection pulse 418 to clear the held contents
5 thereof and successively holds the control signal 420 in
response to the clock signal from the AND circuit 409.
The decoder circuit 412 decodes four held values at the
first, second, fifteenth and sixteenth stages of the 16-
stage shift register 411, and when the decoder circuit
10 detects the start bit and the stop bit in the control
signal 420, the decoder circuit produces a load pulse
422 for the D/AC 413. Further, the output signal from
the second-stage of the shift register 411 is used as a
serial data 421 of the D/AC 413 shown in Fig. 5.

15 The D/AC 413, which is a serial input and
multi-channel D/A converter, selects any of a plurality
of D/A converters included therein in accordance with
D/AC control address in the serial data 421 shown in
Fig. 5 and updates the D/A converted output value in
20 accordance with a value of the control data portion. At
this time, the serial data 421 is successively taken in
the D/AC 413 in synchronism with the clock signal from
the AND circuit 409 and is settled by the rising edge
(UP) of the load pulse from the decoder 412.

25 Thus, the video circuit 20 and the deflection
circuit 21 shown in Fig. 1 can be adjusted by an adjustment
voltage or current produced from the D/AC 413 as an
adjustment signal.

1 Fig. 6 is a block diagram schematically illustrating a second actual example of the control signal separation circuit 18 and the display control circuit 19 of Fig. 1. In Fig. 6, numeral 601 denotes a selector, 5 602 a one-chip microcomputer, and 603 a writable read-only memory (hereinafter referred to as EEPROM (Electric Erasable Programmable Read Only Memory)). Other elements having the same number as in Fig. 4 have the same function.

10 Operation of Fig. 6 is now described.

 The operation that the control signal S_c added to the B' video signal is separated by the AND circuit 408 and the clock signal for writing of the shift register 411 is prepared by the AND circuit 409 is quite 15 the same operation as that of Fig. 4. In the second example, the microcomputer 602 is used to process the control signal to the display unit 1b sent from the computer body 1a shown in Fig. 1.

 First of all, usually, the microcomputer 602 20 controls the selector 601 to select the clock signal for writing from the AND circuit 409 and write the control signal in the shift register circuit 411. At this time, the edge detection pulse from the edge detection circuit 414 is supplied to the microcomputer 602 as an interrupt signal 418 and after a predetermined time the microcomputer 602 controls the selector 601 by a selector control signal S_s to select the clock signal S_{cl} for reading from the microcomputer 602.

1 The control signal held in the shift register
circuit 411 is successively read out in response to the
clock signal S_{CL} for reading from the microcomputer 602
and is supplied to the microcomputer 602. When the
5 signal supplied to the microcomputer is the correct
control signal, the microcomputer 602 produces the
control data to supply it to the D/AC 413 to thereby
adjust a predetermined circuit in the display unit 1b.
Further, the control data is also written in the EEPROM
10 603. Thus, when the display unit 1b is next turned on,
the control data is read out from the EEPROM 603 to
perform the predetermined adjustment.

15 Further, in the second example, by previously
storing the control data in the EEPROM 603, a necessary
control data can be read out in accordance with the
control signal S_c from the computer body 1a. Accord-
ingly, the control information for the display unit 1b
can be previously programmed in the software for
operating the computer body in addition to the control
20 information from the input unit 10, so that a predeter-
mined adjustment can be made for each software.

25 As described above, in the first embodiment of
the present invention, the control signal is added to
the video signal or the synchronizing signal during the
vertical retrace period, while a DC level itself of the
video signal can be used as the control signal. In this
case, the control signal separation circuit 18 may
reproduce the DC level of the video signal and adjust

1 the predetermined circuit of the display unit 1b in
accordance with a voltage value of the DC level.
Further, in the first embodiment, the video circuit 20
and the deflection circuit 21 of the display unit 1b are
5 adjusted, while a high-voltage circuit portion can be
naturally controlled to adjust the focus or the like.

Fig. 7 is a block diagram schematically
illustrating a second embodiment of the present
invention. In Fig. 7, numeral 1c denotes a computer
10 body different from the computer body shown in Fig. 1
and in the computer body 1c, numeral 70 denotes a
control signal preparation circuit. Further, numeral 1d
denotes a display unit different from the display unit
shown in Fig. 1 and in the display unit 1d, numeral 71
15 denotes a second display control circuit different from
the first display control circuit 19 shown in Fig. 1.
Other elements designated by the same numerals as those
of Fig. 1 have the same function as that of the elements
of Fig. 1.

20 Operation of Fig. 7 is now described briefly.

In Fig. 7, the video signal and the synchronizing signal are produced by the display control circuit 15 in the same manner as in a general personal computer or work station.

25 When the user of the computer inputs the control instruction for adjusting the display picture of the display unit 1d by means of the input unit 10 connected to the computer body 1c, the control instruction

1 is sent to the control signal preparation circuit 70
through the input unit interface 12, the CPU 11 and the
computer bus BUS.

The control signal preparation circuit 70
5 holds the control instruction and prepares the control
signal corresponding to the control instruction to
produce it to the display unit 1d at a proper timing.
An output system of the control signal at this time can
use an existing interface such as, for example, RS-232C,
10 GP-IB and SCSI. Accordingly, the control signal pre-
paration circuit 70 includes the interface circuit.

The second display control circuit 71 of the
display unit 1d receives the control signal produced by
the control signal preparation circuit 70 through the
15 same interface circuit as that included in the control
signal preparation circuit 70 and produces the adjust-
ment voltage or current for the video circuit 20 and the
deflection circuit 21 as the adjustment signal on the
basis of the received control signal to adjust the video
20 circuit 20 and the deflection circuit 21.

In the second embodiment of the present
invention, since the control signal is transmitted and
received by means of the general-purpose interface, bi-
directional communication between the display unit 1d
25 and the computer body 1c can be made. Accordingly, the
computer body can recognize whether the display unit 1d
has received the control signal exactly or not, how the
control state of the display unit 1d at the current time

1 is or whether the display unit 1d is exactly operated or
not.

Fig. 8 is a block diagram schematically illustrating a third embodiment of the present invention. In Fig. 8, numeral 1e represents a computer body different from that of Figs. 1 and 7 and in the computer body 1e, numeral 81 represents a display processing circuit for preparing an image data for a display image, and 82 an interface circuit. Numeral 1f represents a display unit different from that of Figs. 1 and 7, 83 an interface circuit, and 84 a display controller for preparing various signals for driving the display unit 1f. The interface circuits (hereinafter referred to as an I/F circuit) 82 and 83 serve to transmit and receive signals between the display processing circuit 81 in the computer body 1e and the display controller 84 in the display unit 1f. Other elements having the same numerals as those of Figs. 1 and 7 have the same function.

Operation of Fig. 8 is now described.

An image processing instruction issued by the CPU 11 is supplied to the display processing circuit 81 through the computer bus BUS. The display processing circuit 81 receives the image processing instruction and prepares the image data for the display image.

At this time, when the user of the computer inputs the control instruction for adjusting the display picture of the display unit 1f by means of the input

1 unit 10 connected to the computer body 1e, the control
instruction is sent to the display processing circuit 81
through the input unit interface 12, the CPU 11 and the
computer bus. When the display processing circuit 81
5 receives the control instruction, the display processing
circuit 81 prepares the control signal in a predeter-
mined location other than the image data area.

The image data and the control signal thus
prepared are sent to the display unit 1f through the I/F
10 circuit 82 as the image information in accordance with a
predetermined interface specification, for example, the
SCSI standards having a large transfer rate.

In the display unit 1f, the I/F circuit 83
receives the image information from the I/F circuit 82
15 and supplies the image information to the display
controller 84 successively. The display controller 84
writes the received image information into an internal
memory successively and prepares the video signals for
R, G and B and the synchronizing signal from the image
20 data portion of the written image information. Further,
when the control signal is present in the image infor-
mation, the adjustment voltage or current as the
adjustment signals Sa' and Sb' for the video circuit 20
and the deflection circuit 21 is produced to adjust the
25 video circuit 20 and the deflection circuit 21.

In addition, when the image information
written in the internal memory of the display controller
84 is not updated within a predetermined time, the

1 display controller 84 controls the video circuit 20 to
minimize an amplitude level of the video signal, so that
the brightness of the cathode ray tube 22 is reduced to
prevent burning of the cathode ray tube 22.

5 Even in the third embodiment of the present
invention, since the interfaces between the computer
body 1e and the display unit 1f have the capability for
bidirectional communication, not only the image data and
the control signal can be transmitted from the computer
10 body 1e but also a signal for reception confirmation and
a report signal for operation situation can be trans-
mitted from the display unit 1f. Further, since the
computer body 1e is connected to the display unit 1f
through a single interface cable, the complexity of the
15 connection can be solved.

Fig. 9 is a block diagram schematically
illustrating a fourth embodiment of the present
invention. In Fig. 9, numeral 1g represents a computer
body different from that of Figs. 1, 7 and 8, and in the
20 computer body 1g, numeral 91 represents a modulation
circuit. Numeral 1h represents a display unit different
from that of Figs. 1, 7 and 8, and in the display unit
1h, numeral 92 represents a display control circuit, 93
a demodulation circuit, and 94 and 95 power plugs.
25 Other elements having the same numerals as those of Fig.
1 have the same function.

Operation of Fig. 9 is now described.

When the user of the computer inputs the

1 control instruction for adjusting the display picture of
the display unit 1h by means of the input unit 10 con-
nected to the computer body 1g, the control instruction
is supplied to the CPU 11 through the input unit inter-
5 face 12. The CPU 11 processes the control instruction
and supplies the control signal corresponding to the
control instruction to the modulation circuit 91 through
the computer bus BUS. The modulation circuit 91 modu-
lates the received control signal and superposes it to
10 the AC power to transmit the signal from the power plug
94 through a power line PL to the display unit 1h.

In the display unit 1h, when the AC power is
supplied from the power plug 95 through the power line
PL, the demodulation circuit 93 demodulates the modu-
15 lated control signal superposed on the AC power to
reproduce the original control signal. The reproduced
control signal is supplied to the display control
circuit 92. The display control circuit 92 produces the
adjustment voltage or current as the adjustment signals
20 Sa and Sb for the video circuit 20 and the deflection
circuit 21 in accordance with the contents of the
control signal to adjust the video circuit 20 and the
deflection circuit 21.

In this manner, in the embodiment, since the
25 control signal is transmitted to the display unit 1h
through the power line PL, the display unit 1h can be
controlled without increased signal line for the control
signal.

1 Fig. 10 schematically illustrates a fifth
embodiment of the present invention. The fifth embodiment
is now described briefly. In Fig. 10, numeral 1
represents a computer body constituted by a general
5 personal computer or work station, 1j a display unit
different from that of the preceding embodiments; 101 a
second input unit such as a keyboard, a mouse, or a pen
for unit connected to the computer body 1 and the
display unit 1j, 102 a command identification circuit in
10 the display unit, and 103 a third display control
circuit. Other elements having the same numerals as
those of Fig. 1 have the same function.

In Fig. 10, when the user of the computer
operates the second input unit 101, an input signal such
15 as the control instruction is inputted to the computer
body 1 and the display unit 1j. The input signal inputted
to the display unit 1j is processed by the command
identification circuit 102 and is taken out as the
display control signal when the input signal is an
20 instruction relative to the display control. The third
display control circuit 103 makes control relative to
the display operation by the control voltage or current
with respect to the associated portion of the video
circuit 20 and the deflection circuit 21 on the basis of
25 the display control signal. In the embodiment of Fig.
10, since the computer body does not prepare the control
signal for the display, there is no burden bearing upon
the CPU of the computer. In this manner, the user of

1 the computer can control the display unit by means of
the second input unit without direct contact to the
display unit. The signal line connected from the second
input unit 101 to the display unit 1j may use the signal
5 lines connected to the computer body 1 as they are or
may be an exclusive signal line for transmitting only
the display control signal. For the former case, the
input unit such as the general keyboard can be utilized
as it is. For the latter case, it is necessary to add a
10 special input unit for display control to the second
input unit. Further, a remote control circuit employing
the infrared rays or the like is used to reduce the
number of connection lines between the second input unit
101 and the display unit 1j, so that the complexity due
15 to wiring can be reduced. In the fifth embodiment, an
input unit such as a mouse, a touch panel, a pen for
input or the like can be naturally used as the input
means for the control instruction in addition to the
keyboard.

20 According to the present invention, the
following effects are attained:

- (1) The user of the computer can adjust the
display picture by the input unit such as the keyboard
near at hand through the computer body without extending
25 the hands to adjustment switches of the display unit.
- (2) The user can obtain the necessary display
state exactly.
- (3) The operability in the computer system and the

- 1 handling capability of the display unit are improved.
- 5 (4) The individual user can adjust the display state of the image display apparatus in accordance with circumstances.
- 5 (5) The adjustment of the display picture can be attained with the minimum control hardware.
- (6) Standard lines can be used without the provision of new lines.
- (7) The complexity due to wiring can be avoided by 10 using the remote control circuit.
- (8) It is possible to automatically adjust the optimum picture to be displayed on the display unit by adjusting the operation of software by means of the control program of a display integrated into the 15 application program at the computer side, and accordingly it is unnecessary for the user to take care the adjustment of the display.